10 years of IPV6 operations

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and a cast of Many

The 6bone era

- 3ffe::/16 usage defined in rfc 2471 (1998)
- Sunset on 06/06/2006
- Allocated hierarchically in a fashion that was the then assumption as to how ipv6 addresses would be allocated.
- Pseudo top-level aggregater (PTLA) and then pseudo next-level aggregator (PNLA).

AS3582

- Initial experience as a 6bone leaf node (PNLA).
- Connected to 3ffe:3700::/24 (Abilene)
- Initial network connectivity was through a PC workstation used as a router.
- Tiny handful of subnets located in one Building

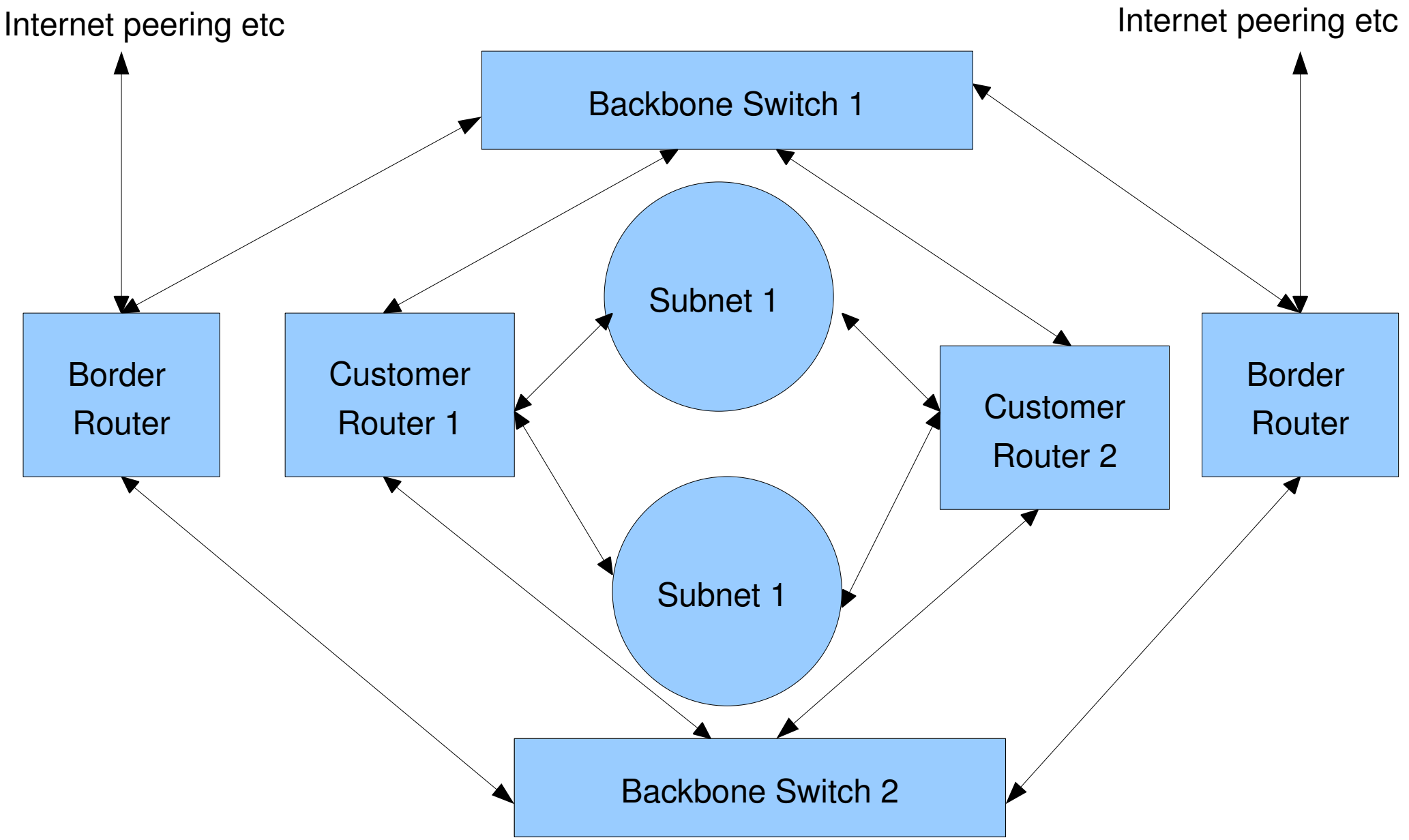
AS3582 continued

- Assigned 2001:468:d01::/48 by upstream (Abilene)
- Renumbered away from 3ffe::/16
- Separate routers (older cisco 7200 npe300) deployed to expand number of subnets served by IPV6, existing core routers (Cat 6500 MSFC2) didn't support dual stack operation.

AS3582 continued

- Following core router upgrade (MSFC 3), collapsed dual router environment in single dual stack router environment.
- Now that it's deployed on our core routers we can do VRRP for ipv6 like we did with IPV4
- Only have one upstream so external routing is simple. Internal is ospfv3.

3582 example



AS 3582 services

- Having IPV6 support on the wire is nice...
  - But it's no the whole story...
- Application and client support are issues.
- Most UNIX systems have support of IPV6 out of the box...
- Windows XP IPV6 optional, Vista on by Default.

AS3582 services

- First step, be able to answer queries for AAAA records.
- Second is IPV6 addresses for you name servers.
- Getting V6 name server information into the clients left as an exercise for the reader (DHCPv6)

AS 3582 services

- When you start putting AAAA records in the DNS for hosts providing services, those services better be able to support IPV6 otherwise customer frustration ensues.
- DNS, NTP, NMS systems, FTP services and ancillary web services were the first services deployed dual stack.

AS3582 Q and A

- Why Deploy IPV6 in AS 3582?

AS12477

- 1998
  - Nokia participation in the 6bone. 3ffe:8130::/28
- 1999
  - Nokia receives 2001:490::/32 under current arin guidelines.

AS12477 3ffe:8130::/28

```
3FFE:8130::/28
  US
  3FFE:8130::/31
    Production
    3FFE:8130::/32
      backbone
      3FFE:8130::/33
    NRC
    3FFE:8131::/32
  Europe
  3FFE:8132::/31
    Production
    3FFE:8132::/32
      backbone
      3FFE:8132::/33
    NRC
    3FFE:8133::/32
  Asia
  3FFE:8134::/31
    Production
    3FFE:8134::/32
      backbone
      3FFE:8134::/33
```

3ffe low detail numbering plan

AS 12477 2001:490::/32 numbering plan

```
2001:0490:0000:/32      # sTLA ARIN
  2001:0490:0000:/36    # Nokia.com
  2001:0490:F000::/36
      2001:0490:F000::/38
        2001:0490:F000::/41 Nokia ISP
        2001:0490:F100::/40 R&D network
        2001:0490:F180::/41
        2001:0490:F200::/41 Americas
             2001:0490:F200::/42 Tunneled
                  2001:0490:F200::/43 Static
                    2001:0490:F200::/48 Point-to-Point
             2001:0490:F240::/42 Native
                  2001:0490:F240::/43 Static
                    2001:0490:F240::/48 Point-to-Point
                    2001:0490:F240:0001::/48 NES
                  2001:0490:F260::/43 BGP
                    2001:0490:F260::/48 Point-to-Point
        2001:0490:F280::/41
        2001:0490:F300::/41 Asia
        2001:0490:F380::/41
      2001:0490:F400::/38 reserved
      2001:0490:F800::/37 reserved
```

2001:490::/32 sparse numbering plan

AS 12477 - 6bone

- 3ffe inside nokia was deployed in separate physical infrastructure centered around paix - palo alto
- Almost all “infrastructure” was tunnels over commodity ipv4 internet.

AS12477 - Now.

- Two networks
  - nokia.net `2001:0490:F000::/36`
  - nokia.com `2001:0490:0000:/36`
- The “experimental network” nokia.net provides v6 connectivity to all subnets it serves ipv4. Dual-Stack routers (nokia ipso boxes) are used throughout the infrastructure edges of the network for other providers still provides on a mix of dual/single stack Cisco and Nokia routers.

AS12477 – Now continued

- Nokia.com provides connectivity to a limited number of subnets in a limited number of geographic locations. But... it's a much larger network. Touching four continents 86 countries 55,000 users.

Why IPV6?

- Between 1990 and 2004 Nokia sold 1 Billion phones.
- Currently selling them at a rate of 100 million per year.
- ~25% of those phones in the next year will support ipv6

Why IPV6

- If the end-to-end principle that created and sustained the Internet and enabled new applications is to survive we need a lot more address space.
- Otherwise we're left with progressively smaller networks segmented with NAT and a need for a lot more middle boxes.
- That's not the future we envision.

Why IPV6

- We're going to need all our ipv4 addresses
- But ipv6 can provide us with stable ip addresses for management and identity purposes.
- IPV4 and IPV6 are going to be deployed in parallel for some time.